

An investigation of the longitudinal proximity effect in superconducting and normal metal TES

Ari-David Brown, James A. Chervenak, Nikhil S. Jethava, Gunther Kletetschka, Vilem Mikula

As the TES volume and (effective) T_c become very small – for volume $< 10 \mu\text{m} \times 10 \mu\text{m} \times 0.5 \mu\text{m}$ and $T_c < 90 \text{ mK}$ – we approach a regime in which the noise equivalent power is dominated by fluctuations in power dissipating from the TES electrons to its phonons. Our ultimate goal is to build a TES bolometer that operates in this regime to be used for far-infrared and sub-mm astronomy. In this study, we characterize the R vs T behavior of small TES in order to engineer a TES bolometer that has a very low T_c . Sadleir et al [1] found that as the distance L between two superconducting leads, with the lead $T_c \gg$ the TES T_c , connected at opposite ends of TES approaches zero, superconductivity is induced parallel to the current flow, or longitudinally, and results in a much higher effective TES T_c . Here we present effective T_c measurements of Mo/Au TES bounded by Nb leads as a function of L which ranges between 4 and 36 μm . We observe that the effective T_c is suppressed for current density of order $10^{-6} \text{ A}/\mu\text{m}^2$. We also explore the possibility of using a normal metal TES.

¹ J. E. Sadleir, S. J. Smith, S. R. Bandler, J. A. Chervenak, and J. R. Clem, "Longitudinal Proximity Effects in Superconducting Transition-Edge Sensors," [arXiv:0910.2451v1](https://arxiv.org/abs/0910.2451v1) (2009).